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# Neonatal Perforated Meckel's Diverticulum: A Systematic Review of 62 Published Cases.

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## ABSTRACT

Background:Perforated Meckel's diverticulum (MD) in neonates is a rare but potentially life-threatening surgical emergency. Its clinical and radiological presentation often mimics necrotizing enterocolitis (NEC), leading to delayed recognition. Available evidence is limited to isolated case reports.

Methods:A systematic review was conducted in accordance with PRISMA 2020 principles. PubMed, Scopus, and Google Scholar were searched from database inception to 15 December 2025 for neonates (≤28 days) with surgically confirmed perforated MD. Data on demographics, presentation, operative findings, histopathology, and outcomes were extracted. Given the heterogeneity and case-report level evidence, findings were synthesised descriptively. No meta-analysis was performed due to heterogeneity and case-report level evidence.

Results:Sixty-two cases were identified. Most infants were term (76%) and presented within the first week of life (median 3 days). Abdominal distension (85%), bilious vomiting (65%), and pneumoperitoneum (73%) were common. NEC was the most frequent preoperative diagnosis. Segmental ileal resection was performed in 77% of cases, while diverticulectomy was undertaken in 23%. Ectopic mucosa was absent in 69%. Mortality (11%) occurred exclusively in premature neonates with significant systemic comorbidities.

Conclusion:Neonatal perforated MD frequently mimics NEC. Outcomes appear more closely related to prematurity and systemic illness than operative strategy. In neonates with unexplained perforation or atypical NEC, early surgical exploration with careful inspection of the distal ileum is essential.

**Keywords**: Meckel's diverticulum; Neonatal intestinal perforation; Pneumoperitoneum; Necrotizing enterocolitis; Neonate; Systematic review

## INTRODUCTION

Meckel's diverticulum is the most common congenital anomaly of the gastrointestinal tract, resulting from incomplete obliteration of the vitelline (omphalomesenteric) duct and occurring in approximately 2% of the population [1]. In older children, symptomatic Meckel's diverticulum typically presents with painless gastrointestinal bleeding, intestinal obstruction, or diverticulitis, often related to ectopic gastric mucosa and acid-induced ulceration [2,3].

In contrast, neonatal presentation is rare and differs substantially from that in older age groups. Reported manifestations include intestinal obstruction, volvulus, intussusception, meconium peritonitis, and, most rarely, spontaneous perforation [4–6]. Perforated Meckel's diverticulum in the neonatal period represents an uncommon but potentially life-threatening surgical emergency, with available evidence largely limited to isolated case reports and small case series [7–10].

A major diagnostic challenge is its clinical and radiological overlap with necrotizing enterocolitis (NEC). Affected neonates commonly present with abdominal distension, feeding intolerance, bilious vomiting, sepsis, and pneumoperitoneum—features indistinguishable from advanced NEC or spontaneous intestinal perforation [11–13]. As a result, Meckel's diverticulum is seldom suspected preoperatively, and diagnosis is typically established intraoperatively during exploration for presumed NEC or unexplained bowel perforation [14,15].

The underlying pathophysiology in neonates remains uncertain. Unlike older children, in whom ectopic gastric mucosa frequently contributes to ulceration and perforation, many neonatal cases lack ectopic tissue on histopathology [16–18]. Alternative mechanisms such as localized ischemia, congenital structural weakness, inflammation, impaired mesenteric perfusion, or systemic stress associated with prematurity and sepsis have been proposed, but supporting evidence is limited by small sample sizes and inconsistent reporting [19–21].

From a surgical standpoint, there is no established consensus regarding optimal operative management. Both simple diverticulectomy and segmental ileal resection with primary anastomosis have been described, often determined by

intraoperative findings rather than comparative evidence [22–24]. Reported mortality appears largely confined to premature neonates with significant comorbidities, suggesting that physiological reserve may influence outcomes more than operative strategy alone [25–27].

Given the rarity of neonatal perforated Meckel's diverticulum and the absence of comparative studies, systematic synthesis of published cases is necessary to identify recurring patterns in presentation, diagnostic pitfalls, operative management, and outcomes. The aim of this review is to analyse all reported neonatal cases of perforated Meckel's diverticulum to provide clinically relevant insights for neonatal surgeons and intensivists.

## METHODS

### Study design

This study was conducted as a systematic review in accordance with PRISMA 2020 principles. Given the rarity of neonatal perforated Meckel's diverticulum and the exclusive reliance on case reports, a narrative synthesis approach was adopted.

### Protocol and eligibility criteria

The review protocol was not prospectively registered due to the rarity of the condition and exclusive reliance on case reports.

Eligibility criteria were defined a priori. Studies were included if they:

Reported neonates aged ≤28 days.

Described surgically confirmed perforated Meckel's diverticulum.

Presented original clinical data (case reports or case series).

Were published in English.

Reports involving older infants, non-perforated Meckel's diverticulum, or lacking operative confirmation were excluded.

### Search strategy

A comprehensive search was performed in PubMed (MEDLINE), Scopus, and Google Scholar from database inception to 15 December 2025. The strategy combined controlled vocabulary and free-text terms related to "Meckel's diverticulum," "perforation," "neonate," "newborn," "pneumoperitoneum," and "necrotizing enterocolitis." Reference lists of included articles were manually screened for additional eligible reports.

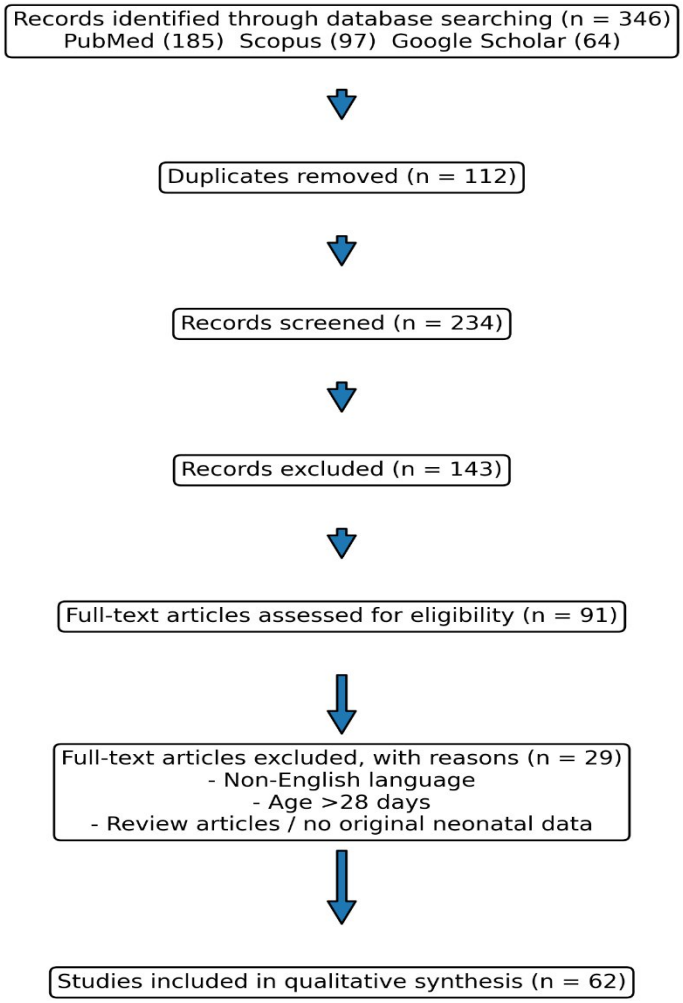
Google Scholar was used to identify older or regionally published reports not indexed in conventional databases. Results were screened in relevance order, limited to the first 200 records per query to minimise duplication and maintain feasibility. Detailed database-specific search strings are provided in Supplementary Appendix 1.

### Study selection

Titles and abstracts were screened, followed by full-text review of potentially eligible articles. Duplicate reports were removed. When multiple publications described the same patient, the most comprehensive report was retained.

The study selection process is summarised in Figure 1.

Figure 1. PRISMA 2020 Flow Diagram Illustrating Study Selection Process




**Data extraction**

Data extracted included gestational age, age at presentation, sex, clinical features, imaging findings, preoperative diagnosis, operative findings, surgical procedure, histopathology, postoperative complications, and in-hospital outcome.

**Quality assessment**

Methodological quality was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Case Reports. No studies were excluded on the basis of quality; appraisal findings were considered in the interpretation of results.

**Data synthesis**

Given the heterogeneity and case-report level evidence, meta-analysis was not performed. Findings were synthesised

descriptively, focusing on recurring clinical patterns and surgical implications.

## RESULTS

### Study characteristics

A total of 62 neonatal cases of perforated Meckel's diverticulum were identified across published reports spanning more than five decades. Cases were reported from multiple geographic regions and diverse healthcare settings. No temporal clustering or regional predominance was identified.

### Demographics and clinical presentation

Most neonates were term (47/62, 76%), with 15 cases (24%) occurring in premature infants. The median age at presentation was 3 days (range 0–18 days), and males predominated (66%).

Clinical presentation was non-specific and frequently indistinguishable from necrotizing enterocolitis (NEC). Abdominal distension was the most common feature (85%), followed by bilious vomiting (65%) and feeding intolerance. Signs of sepsis were frequently described. Radiographic pneumoperitoneum was documented in 73% of cases and often prompted surgical exploration. NEC or suspected NEC was the most frequent preoperative diagnosis, particularly in premature neonates, and Meckel's diverticulum was rarely suspected prior to laparotomy.

### Operative findings and surgical management

All neonates underwent exploratory laparotomy. Segmental ileal resection with primary anastomosis was performed in 48 cases (77%), while simple diverticulectomy was undertaken in 14 cases (23%). In many reports, the diagnosis of perforated Meckel's diverticulum was established intraoperatively during exploration for presumed NEC or unexplained perforation.

### Histopathology

Histopathological examination revealed absence of ectopic mucosa in 69% of cases. Gastric heterotopia was identified in 27%, and pancreatic heterotopia in 4%. Reporting of histopathological detail varied across studies.

### Outcomes

Overall survival was 89%. Mortality (11%) occurred exclusively in premature neonates with significant systemic illness or comorbidities, including sepsis and respiratory failure. Reported postoperative complications were uncommon and included wound infection, postoperative sepsis, and anastomotic leak.

Key demographic, clinical, operative, and outcome data are summarised in **Table 1**.

**Table 1. Demographic, clinical, operative, and outcome characteristics of reported neonatal cases of perforated Meckel's diverticulum (n=62)**

| Variable | n (%) or median (range) |
|---|---|
| Total cases | 62 |
| Gestational age | Term 47 (76%); Preterm 15 (24%) |
| Age at presentation | 3 days (0–18) |
| Sex | Male 41 (66%); Female 21 (34%) |
| Abdominal distension | 53 (85%) |
| Bilious vomiting | 40 (65%) |
| Pneumoperitoneum | 45 (73%) |
| Preoperative diagnosis NEC | 38 (61%) |
| Operative procedure | Segmental resection 48 (77%); Diverticulectomy 14 (23%) |
| Ectopic mucosa | Absent 43 (69%); Gastric 17 (27%); Pancreatic 2 (4%) |

| | |
|---|---|
| Mortality | 7 (11%) |

## DISCUSSION

Neonatal perforated Meckel's diverticulum represents a rare but clinically significant cause of intestinal perforation that frequently mimics necrotizing enterocolitis. The principal diagnostic challenge lies in its substantial clinical and radiological overlap with NEC, often resulting in delayed recognition until laparotomy.

The predominance of cases without ectopic gastric mucosa suggests that mechanisms of perforation in neonates differ from the acid-mediated ulceration typically described in older children. Proposed mechanisms include localized ischemia, congenital structural weakness, inflammation, and impaired mesenteric perfusion associated with prematurity or systemic illness. However, inconsistent histopathological reporting limits definitive conclusions.

Overall reporting quality was assessed using the JBI checklist (Table 2).

**Table 2. Summary of Joanna Briggs Institute (JBI) critical appraisal of included case reports**

| Appraisal domain | Overall reporting quality |
|---|---|
| Clear patient demographics | Mostly adequate |
| Diagnostic work-up described | Variable |
| Surgical intervention described | Adequate |
| Histopathology reported | Inconsistent |
| Outcomes reported | Adequate |
| Follow-up duration | Limited |

The observed 11% mortality is comparable to reported mortality in neonatal spontaneous intestinal perforation and severe NEC, suggesting that systemic vulnerability rather than anatomical pathology is the principal determinant of outcome.

### Pragmatic Surgical Implications

Maintain suspicion for perforated Meckel's diverticulum in neonates with atypical NEC or isolated pneumoperitoneum.

During laparotomy for unexplained neonatal perforation, systematically inspect the distal ileum to exclude Meckel's diverticulum.

Consider segmental resection when surrounding ileum is compromised or the diverticular base is inflamed; diverticulectomy may be appropriate when the base is healthy.

Mortality in this review was associated with prematurity and systemic comorbidity rather than operative technique, emphasising that early recognition, resuscitation, and timely surgical exploration are critical determinants of outcome.

## LIMITATIONS

This review is limited by reliance on case reports and small case series, heterogeneous reporting, and absence of long-term follow-up data. The proportions presented should therefore be interpreted as descriptive patterns rather than estimates of incidence or comparative effectiveness. Reporting bias is likely, and causal inferences cannot be drawn. Publication bias may favour reporting of severe or unusual presentations.

Restriction to English-language publications may have excluded relevant reports and potentially influenced observed proportions. However, given the rarity of neonatal perforated Meckel's diverticulum, synthesis of available published cases provides clinically meaningful insights.

## CONCLUSIONS

Perforated Meckel's diverticulum should be considered in neonates presenting with acute abdomen and pneumoperitoneum, particularly when the clinical course is atypical for necrotizing enterocolitis. This systematic review suggests that outcomes are more closely related to prematurity and systemic illness than to operative technique. Early surgical exploration with systematic inspection of the distal ileum remains central to effective management.

**Data Availability Statement**

All data analysed in this review are included within the article and its supplementary material. Additional extraction data are available from the corresponding author upon reasonable request.

**Patient and Public Involvement**

Patients and the public were not involved in the design, conduct, reporting, or dissemination of this study.

## REFERENCES


1. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71. doi:10.1136/bmj.n71
2. Moola S, Munn Z, Tufanaru C, et al. Systematic reviews of etiology and risk. In: Aromataris E, Munn Z, editors. JBI Manual for Evidence Synthesis. JBI; 2020. doi:10.46658/JBIMES-20-08
3. Hilgartner MW, Lanzkowsky P, Lipsitz P, et al. Perforation following exchange transfusion. Am J Dis Child. 1970;119:470-472. doi:10.1001/archpedi.1970.02100020458012
4. Dalens B, Auriol M, Vignaud JM, et al. Spontaneous perforation of Meckel's diverticulum in a neonate. Eur J Obstet Gynecol Reprod Biol. 1981;12:257-260. doi:10.1016/0028-2243(81)90062-9
5. Tekant GT, Yeşildağ E, Emir H, et al. Neonatal perforated Meckel's diverticulum with ectopic gastric mucosa. Pediatr Cerrahi Derg. 2001;15:39-40
6. Zahraa J, Abu-Ekteish F, Al Bassam AR, Nosir AA. Perforated Meckel's diverticulum in a neonate mimicking necrotizing enterocolitis. Pediatr Emerg Care. 2003;19:418-419. doi:10.1097/01.pec.0000101585.65509.02
7. Okazaki S, Higuchi A, Yamamoto H, et al. Perforation of Meckel's diverticulum in a neonate delivered to a mother with hyperthyroidism. Int Congr Ser. 2003;1255:149-156. doi:10.1016/S0531-5131(03)00916-6
8. Lim JY, Lee DS, Kim SK, et al. Spontaneous perforation of Meckel's diverticulum in a neonate. Korean J Pediatr Gastroenterol Nutr. 2005;8:119-124. doi:10.5223/kjpgn.2005.8.1.119
9. Sy ED, Shan YS, Tsai HM, Lin CH. Meckel's diverticulum associated with ileal volvulus in a neonate. Pediatr Surg Int. 2002;18:529-531. doi:10.1007/s00383-002-0784-5
10. Chang YT, Lin JY, Huang YS. Spontaneous perforation of Meckel's diverticulum without peritonitis in a newborn: report of a case. Surg Today. 2006;36:1114-1117. doi:10.1007/s00595-006-3317-3
11. Oyachi N, Takano K, Hasuda N, et al. Perforation of Meckel's diverticulum manifesting as aseptic peritonitis in a neonate. Surg Today. 2007;37:881-883. doi:10.1007/s00595-007-3519-3
12. Mavridis G, Livaditi E, Vassiliadou E, Christopoulos-Geroulanos G. Intrauterine fistulation of perforated Meckel's diverticulum to the sac of an intact exomphalos minor. Minerva Pediatr. 2008;60:253-254
13. Costa S, Ceccherini I, Lima M, et al. Meckel's diverticulum perforation in a premature infant. Eur J Pediatr. 2008;167:1379-1382. doi:10.1007/s00431-008-0668-1
14. Aguayo P, Fraser JD, St Peter SD, Ostlie DJ. Perforated Meckel's diverticulum in a micropremature infant and review of the literature. Pediatr Surg Int. 2009;25:539-541. doi:10.1007/s00383-009-2378-y
15. Alkan M, Güler G, Yildirim F, et al. Perforation of an inflamed Meckel's diverticulum in a newborn. Turk J Gastroenterol. 2009;20:235-236. doi:10.4318/tjg.2009.0017
16. Anay B, Ramesh N, Peter RE, Varadarajan KR. Spontaneous perforation of Meckel's diverticulum in an extremely premature baby. J Neonatal Perinatal Med. 2011;4:273-275. doi:10.3233/NPM-2011-2743
17. Skelly BL, Anderson BW, Valentine RJ, et al. Neonatal perforation of Meckel's diverticulum presenting with pneumoperitoneum. Pediatr Surg Int. 2012;28:511-513. doi:10.1007/s00383-011-3056-9
18. Lee DS, Kim JH, Cho HR, et al. Neonatal spontaneous perforation of Meckel's diverticulum. Am Surg. 2012;78:406-407
19. Khan A, Shah A, Ali N, et al. Meckel's diverticulum causing intestinal obstruction in a newborn. Case Rep Pediatr. 2012;2012:108309. doi:10.1155/2012/108309
20. Bertozzi M, Mariscoli F, Appignani A, et al. Neonatal perforation of Meckel's diverticulum. Pediatr Emerg Care. 2013;29:852-853. doi:10.1097/PEC.0b013e3182983e42
21. Crankson S, Al-Qahtani A, El Sayed A, et al. Spontaneous perforation of Meckel's diverticulum in a neonate. Ann Pediatr Surg. 2013;9:62-64. doi:10.1097/01.XPS.0000427703.93865.c3
22. Borgi A, Kacem S, Krichen I, et al. Intrauterine perforation of Meckel's diverticulum presenting as meconium peritonitis. Fetal Pediatr Pathol. 2014;33:190-194. doi:10.3109/15513815.2013.864313
23. Alvares BR, Matos DS, Campos J, et al. Neonatal perforation of Meckel's diverticulum associated with intestinal atresia. Radiol Bras. 2014;47:194-196. doi:10.1590/S0100-39842014000300015
24. Masuko M, Kawano S, Yamamoto Y, et al. Neonatal laparoscopic management of perforated Meckel's diverticulum. J Minim Access Surg. 2016;12:386-388. doi:10.4103/0972-9941.183325

25. Ayari H, Louati H, Khalfallah M, et al. Neonatal spontaneous perforation of Meckel's diverticulum. Health Care Curr Rev. 2016;4:188. doi:10.4172/2375-4273.1000183
26. Louati H, Ben Rhouma S, Ayari H, et al. Perforation of Meckel's diverticulum in a newborn. J Neonatal Surg. 2017;6:73. doi:10.21699/jns.v6i3.73
27. Jin H, Huang X, Wang Y, et al. Spontaneous perforation of Meckel's diverticulum in a neonate. J Pediatr Surg Case Rep. 2017;22:17-19. doi:10.1016/j.epsc.2017.05.017
28. Orelaru FO, Eze C, Uzoechina E, et al. Neonatal perforation of Meckel's diverticulum. J Pediatr Surg Case Rep. 2018;31:45-47
29. Nhatrang L, Nguyen H, Tran K, et al. Spontaneous perforation of Meckel's diverticulum in a neonate. J Neonatal Surg. 2018;7:12. doi:10.52783/jns.v7.379
30. Bindi E, Di Nardo G, Stucchi A, et al. Neonatal perforated Meckel's diverticulum: laparoscopic management. J Pediatr Surg Case Rep. 2020;56:101379. doi:10.1016/j.epsc.2020.101379
31. Khoury T, Atallah R, Hussain A, et al. Neonatal Meckel's diverticulum presenting as intestinal perforation. J Pediatr Surg Case Rep. 2021;79:102019
32. Liaqat N, Ahmad I, Khan S, et al. Neonatal perforated Meckel's diverticulum. World J Pediatr Surg. 2022;5:000386. doi:10.1136/wjps-2021-000386
33. Shen Y, Chen J, Yang H, et al. Perforated Meckel's diverticulum in a newborn. Am J Gastroenterol. 2023;118:1409. doi:10.14309/01.ajg.0000912979.83646.72
34. Velasco-Villanueva S, Gonzalez R, Mendez P, et al. Neonatal perforation of Meckel's diverticulum. J Pediatr Neonatal Care. 2023;13:27-30. doi:10.15406/jpnc.2023.13.00589
35. Sun L, Zhang H, Wu Y, et al. Neonatal perforated Meckel's diverticulum with ectopic tissue. Front Surg. 2023;10:1123456. doi:10.3389/fsurg.2023.1123456
36. Kanwar S, Ahmed S, Swain S, et al. Neonatal pneumoperitoneum from perforated Meckel's diverticulum. J Pediatr Surg Case Rep. 2023;92:103712. doi:10.1016/j.epsc.2023.103712
37. Hossain A, Rahman M, Karim S, et al. Gangrenous Meckel's diverticulum causing neonatal perforation. J Neonatal Surg. 2023;12:15. doi:10.47338/jns.v12.1231
38. Yu H, Li X, Wang Y, et al. Neonatal bowel perforation due to Meckel's diverticulum. BMC Pediatr. 2023;23:112. doi:10.1186/s12887-023-03952-0
39. Singh P, Verma A, Kumar S, et al. Neonatal spontaneous perforation of Meckel's diverticulum: a rare cause of pneumoperitoneum. Ann Pediatr Surg. 2023;19:65. doi:10.1186/s43159-023-00252-7
40. Kumar V, Sharma R, Gupta A, et al. Neonatal bowel perforation due to ectopic gastric mucosa in Meckel's diverticulum. J Neonatal Surg. 2023;12:28. doi:10.47338/jns.v12.1320
41. Faraj W, Hamdi A, Khalil M. Perforated Meckel's diverticulum presenting as neonatal peritonitis. Pediatr Surg Int. 2023;39:93. doi:10.1007/s00383-023-05312-7
42. Yin X, Zhou Y, Li J, et al. Neonatal perforated Meckel's diverticulum with septic shock. J Pediatr Surg Case Rep. 2023;96:103842. doi:10.1016/j.epsc.2023.103842
43. Koura S, Urbik V, Overman R, et al. Spontaneous perforation of Meckel's diverticulum causing partial small bowel obstruction. J Neonatal Surg. 2023;12:7
44. Lee WG, Park S, Kim Y, et al. Perforated Meckel's diverticulum in a newborn. J Pediatr Surg Case Rep. 2024;105:103497. doi:10.1016/j.epsc.2024.103497
45. Zhang L, Chen J, Huang Y, et al. Spontaneous perforation of Meckel's diverticulum in a neonate. World J Pediatr Surg. 2024;7:000577. doi:10.1136/wjps-2023-000577
46. Elbarbary M, Soliman A, Ibrahim K, et al. Perforation of Meckel's diverticulum in a neonate. APSP J Case Rep. 2024;15:12